

### REMARKS

Reconsideration of the claims in light of the following remarks is requested. Upon entry of this amendment Claims 1 – 6, and 8 – 28 are pending and under consideration. Claims 1, 12 and 19 have been amended. New claims 26 to 28 are added. Claim 7 is canceled. Applicant respectfully submits that no new matter is added by this amendment.

Applicants have not dedicated or abandoned any unclaimed subject matter and moreover have not acquiesced to any rejections made by the Patent Office. Applicants reserve the right to pursue prosecution of any presently excluded claim embodiments in future continuation and/or divisional applications.

#### Claim Amendments

Claims 1, 12, and 19 has been amended to recite specific temperature ranges and chemical formulas. New claims 26 to 28 have been added which recite an additional temperature range. Support for these amendments are found in the specification; for example, at page 5, lines 6-8, at page 6, lines 1 and 24, and in original claim 7.

#### Objection to the Specification

The disclosure is objected to because of informalities. The specification has been amended to correct the informalities and Applicants respectfully request the objection be withdrawn.

#### Claim Rejections - 35 U.S.C. § 102

Claims 1-9, 12-16, and 19-23 stand rejected under 35 U.S.C. § 102 (e) as being anticipated by Baum et al., (U.S. Patent No. 6,869,638) (“*Baum*”).

For an anticipation rejection under 35 U.S.C. § 102 to be proper, a single reference must disclose each and every element of a claim. *In re Paulsen*, 31 USPQ2d 1671, 1673 (Fed. Cir. 1994); M.P.E.P. § 2131.

Claims 2-9 depend from claim 1; claims 13-16 depend from claim 12; claims 20-23 depend from claim 19. Claims 1, 12, and 19 as amended recite: "the temperature of the wafer is maintained between from about 100°C to about 500°C."

In contrast, *Baum* discloses that the deposition is "preferably carried out under elevated temperature in a range from about 250 °C. [sic] to about 750°C." See col. 15, lines 58-61. *Baum* also discloses a CVD method in which "the temperature in the chemical vapor deposition zone is between about 350 °C. [sic] to about 750°C." See claim 46. *Baum* further discloses several tests to compare the use of oxygen and N<sub>2</sub>O as oxidant, and all the tests were carried out at a temperature at or above 400°C (400°C to 650°C). See Examples and Figures 2, 4, and 6- 11.

Therefore, *Baum* discloses CVD methods where deposition is carried out at temperature range of 250°C to 750°C, or 350°C to 750°C. Thus, it does not teach "the temperature of the wafer is maintained between from about 100°C to about 500°C" as recited in amended claims 1, 12, 19 (and claims depend therefrom).

Applicants further note that new claim 26, which recites "the temperature of the wafer is maintained between from 200°C to about 400°C" is also not anticipated by *Baum* even if claim 24 recites a range narrower than the ranges disclosed by *Baum*. On this issue, Applicants respectfully draw the Examiner's attention to MPEP § 2131.03, which states:

If the claims are directed to a narrow range, and the reference teaches a broad range, depending on the other facts of the case, it may be reasonable to conclude that the narrow range is not disclosed with "sufficient specificity" to constitute an anticipation of the claims. See, e.g., *Atofina v. Great Lakes Chem. Corp*, 441 F.3d 991, 999, 78 USPQ2d 1417, 1423 (Fed. Cir. 2006) wherein the court held that a reference temperature range of 100-500 degrees C did not describe the claimed range of 330-450 degrees C with sufficient specificity to be anticipatory.

Applicants further draw the Examiner's attention to MPEP § 2131.03 regarding overlap ranges:

Further, while there was a slight overlap between the reference's preferred range (150-350 degrees C) and the claimed range, that overlap was not sufficient for anticipation. "[T]he disclosure of a range is no more a disclosure of the end points of the range than it is each of the intermediate points." *Id.* at 1000, 78 USPQ2d at 1424.

Indeed, the instant application illustrates the significant impact a slight change in temperature can have on the resulting film. Specifically, at page 8, lines 19 – 31 the present application states, in part:

In addition, it was determined that the percentages of hafnium and silicon in the resultant film are tied to wafer temperature. Specifically, the percentage of hafnium decreased and the percentage of silicon increases as the wafer temperature rises. In fact, the percentage of silicon nearly doubles as wafer temperature rises from 300 °C to 400 °C, but then plateaus and does not show much increase to 450 °C. . . .

Page 8, lines 19 – 24.

Further, *Baum* does not disclose the silicon precursor as recited in Applicant's amendment claims. *Baum* teaches an aminosilane compound as the silicon precursor, see abstract and col. 9, line 52, not a silicon alky amide as recited in Applicant's amended claims.

For the foregoing reasons, claims 1-9, 12-16 and 19-23 are not anticipated by *Baum*, and Applicants respectfully request the rejections be withdrawn.

#### Claim Rejections - 35 U.S.C. § 103

Claims 10, 11, 17, 18, 24, and 25 stand rejected under 35 U.S.C. § 103 (a) as being obvious over *Baum* in view of Metzner et al., (U.S. Patent Application Publication 2003/0232506 ("*Metzner*").

When rejecting claims under 35 U.S.C. §103(a), the Examiner bears the burden of establishing a *prima facie* case of obviousness. See, e.g., *In re Bell* 26 USPQ2d 1529 (Fed. Cir. 1993). To establish a *prima facie* case the prior art reference(s) must teach or suggest each and every limitation of the rejected claims. M.P.E.P. §2142.

Claims 10 and 11 depend from claim 1; claims 17 and 18 depend from claim 12; claims 24, and 25 depend from claim 19. As presented above, *Baum* discloses CVD methods with deposition carried out at temperature ranges of 250°C to 750°C, or 350°C to 750°C, but does not teach "the temperature of the wafer is maintained between from about 100°C to about 500°C" as

recited in amendment claims 1, 12, 19 (and claims depending therefrom). This defect is not cured by *Metzner*.

*Metzner* discloses a method of forming a hafnium oxide layer in the range of about 220°C to about 700°C, and preferably at about 485°C. See paragraph [0037].

Thus, neither *Baum* nor *Metzner* teaches “the temperature of the wafer is maintained between from about 100°C to about 500°C” as requested by claims 1, 12, 19 (and claims depending therefrom).

Further, the claimed invention is not obvious in view of *Baum* nor *Metzner* because both each away from the claimed invention.

The instant application is directed to ALD formation of metal silicates from a metal organic precursor, a silicon organic precursor, and ozone. Specifically ozone is used as oxidant instead of oxygen gas. In contrast, *Baum* and *Metzner* are directed to CVD or ALD process where oxygen gas is used as oxidant.

The Examiner appears to take the position since *Baum* provides a list of oxygen sources including ozone, a skilled person would consider trying to use ozone. However, Applicant respectfully submits this is hindsight because neither *Baum* nor *Metzner* provided such motivation to try, and the Examiner fails to point to any support to provide such motivation. In fact, *Baum* and *Metzner* teaches way from the use of ozone as oxygen source.

Traditionally, oxygen gas and steam have been preferred oxidants in ALD processes. Although ozone has been recognized as an oxidant, it is disfavored due to its relatively high instability. This is further evidenced by *Baum*, which discloses the comparison of using oxygen gas and N<sub>2</sub>O as oxidant. See Examples. This is also evidenced by *Metzner*, which discloses the use of oxygen gas as oxidant. See paragraph [0036].

Moreover, both *Baum* and *Metzner* disclose deposition at high temperature. *Baum* discloses that the deposition is “preferably carried out under elevated temperature in a range from about 250 °C. [sic] to about 750°C.” See col. 15, lines 58-61. In addition, *Baum* discloses a CVD method in which “the temperature in the chemical vapor deposition zone is between about 350 °C. [sic] to about 750°C.” See claim 46. Further, *Baum* discloses several tests to

compare the use of oxygen and  $N_2O$  as oxidant, and all the tests were carried out at a temperature at or above  $400^{\circ}C$  ( $400^{\circ}C$  to  $650^{\circ}C$ ). See Examples and Figures 2, 4, and 6- 11. *Metzner* discloses method of forming a hafnium oxide layer in the range about  $220^{\circ}C$  to  $700^{\circ}C$ , and preferably at about  $485^{\circ}C$ . See paragraph [0037].

However, the present application discloses that ozone is actually the preferred oxidant in the formation of metal silicate films by ALD. This is because oxygen gases require operating temperature around  $400^{\circ}C$ . In contrast, ozone permits operations temperature below  $300^{\circ}C$ . The instant application further discloses:

By using ozone in the ALD process, as opposed to conventional oxidants such as oxygen gas and steam, the fixed and trapped charges in the resultant metal silicate are reduced. In addition, the required operating temperatures are reduced .... Whereas steam causes hydroxyl contamination in the resultant film, ozone produces films free of such contamination.

Page 7, lines 15-24.

Thus both *Baum* and *Metzner* actually teach away from using ozone as oxygen source because a skilled person, upon reading *Baum* or *Metzner*, will use high temperatures, such as  $400^{\circ}C$  to  $650^{\circ}C$ , preferably  $485^{\circ}C$ , even up to  $700^{\circ}C$  or  $750^{\circ}C$ , and would not use ozone which is not preferred for such high temperature.

For the foregoing reasons, *Baum* and *Metznes*, either alone or in combination, fail to teach each and every limitation of the claimed invention, and both actually teach away from the claimed invention. As such, the rejection on this ground is improper and should be withdrawn.

#### Information Disclosure Statement

An Information Disclosure Statement is filed concurrently herewith to bring to the Examiner's attention a European Office Action and cited references recently received in counterpart European Patent Application No. 03 788 581.1. Applicant respectfully submits that the amended claims are patentable over these cited references.

**CONCLUSION**

Based on the foregoing, Applicant submits that Claims 1 – 6, and 8 – 28 are in condition for allowance. An early indication of the same is therefore respectfully requested. If any matters can be resolved by telephone, the Examiner is invited to call the undersigned attorney at the telephone number listed below. No fees beyond those being submitted concurrently herewith are believed due. However, the Commissioner is authorized to charge any additional required fees, or credit any overpayment, to Morgan, Lewis & Bockius LLP Deposit Account No. 50-0310 (Order No. 067538-5171-US).

Respectfully submitted,

August 3, 2007

Date:

  
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